



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of Yasunori UETANI et al.

Serial No. 09/323,230

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Group Art Unit : 1752

Examiner : CHU, JOHN S.

A POSITIVE RESIST COMPOSITION

\* \* \* \* \*

DECLARATION

I, Hiroshi MORIUMA, residing at 2-11-7-404,  
Sonehigashino-cho, Toyonaka-shi, Osaka, 561-0802, Japan, declare  
and say:

that I graduated and obtained Master Degree from Graduate School  
of Engineering, Osaka Prefecture University in March, 1989.

Since April 1989 to the present, I have been employed by  
Sumitomo Chemical Co., Ltd., assignee of the above-identified  
application, and engaged in research and development in the field of  
syntheses of resins and of product developments for photoresist  
compositions;

that I am one of the inventors of the invention of the  
above-identified application; and

that in order to show the excellent effect of the present invention, I beg

to submit the following experimental data which have been obtained under my supervision:

### Experiments

To compare the resolution exhibited by an article comprising a resist composition containing thioxanthone compound with those comprising a resist composition containing other aromatic ketone described in U.S.P.4,356,255, the following Experiments were conducted.

#### Kind of Ingredients in Resist Compositions

(Resin)

2-Heptanone solution of Resins A and B

Weight ratio: 30 / 70 (Resin A / Resin B)

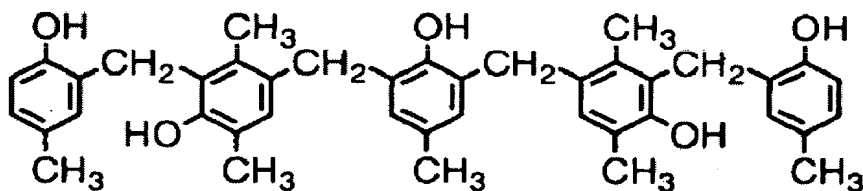
The 2-heptanone solution of Resins A and B were obtained in the same manner as in Reference Example 1 and 2 in the present specification respectively.

(Additive)

4,4'-(2-hydroxybenzilidene)di-2,6-xlenol

(Radiation-sensitive ingredient)

A condensate of 2,6-bis[4-hydroxy-3-(2-hydroxy-5-methylbenzyl)-2,5-dimethylbenzyl]-4-methylphenol of the following formula:



with 1,2-naphthoquinonediazide-5-sulfonyl chloride in the reaction molar ratio of 1:2.2

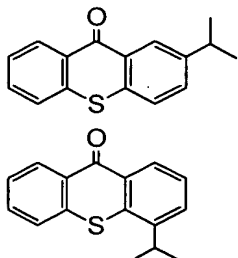
(X Component)

In Example 1: a mixture of 2-isopropylthioxanthone and 4-isopropylthioxanthone

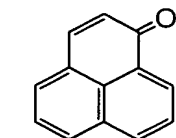
In Comparative Example 1: perinaphthenone

In Comparative Example 2: 9-fluorenone

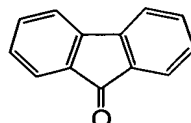
In Comparative Example 3: xanthone



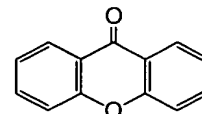
Isopropylthioxanthone



perinaphthenone



9-fluorenone



xanthone

(Solvent)

2-Heptanone

Into a flask were mixed 11 parts of Resins A and B (converted to solid content), 4 parts of Additive, 6 parts of Radiation-sensitive ingredient, 0.2 part of X component, and 60 parts in total of Solvent to obtain solution (the amount of Solvent includes the amount derived from the 2-heptanone solution of Resins A and B.).

The respectively obtained solutions were filtered by a fluorine resin filter to give resist solutions. The resist solutions were spin-coated on silicon wafers treated with hexamethylsilazane and subjected to the pre-baking treatment at 90 °C for 60 seconds on a direct hot-plate to form resist films having a thickness of 0.85 μm. The wafers carrying the resist films were exposed using a line and space pattern varying stepwise the exposure amount using an i-ray stepper ("NSR-2005 i9C", manufactured by Nikon Co., Ltd., NA=0.57, σ=0.60). Then, they were subjected to post-exposure baking under conditions of 110°C and 60 seconds on a hot plate, followed by paddle development using a 2.38% aqueous tetramethylammonium hydroxide solution for 60 seconds.

The developed patterns were observed by a scanning electron microscope. The effective sensitivity and resolution for respective patterns were evaluated in the same manners as in Examples and Comparative Examples in the present specification. The results are shown in Table 1.

Table 1

Example No.	Resin	X Component	Effective Sensitivity	Resolution
Example 1	A/B 30/70	Isopropylthioxanthone 0.2 part	380 msec	0.28 $\mu\text{m}$
Comparative Example 1	A/B 30/70	Perinaphthenone 0.2 part	250 msec	0.33 $\mu\text{m}$
Comparative Example 2	A/B 30/70	9-Fluorenone 0.2 part	260 msec	0.32 $\mu\text{m}$
Comparative Example 3	A/B 30/70	Xanthone 0.2 part	250 msec	0.33 $\mu\text{m}$

The article comprising a resist composition containing thioxanthone compound and corresponding to the present invention exhibits higher resolution compared with the articles comprising compositions containing perinaphthenone, 9-fluorenone and xanthone described in U.S.P.4,356,255 as other aromatic ketones and having similar structures to the thioxanthone compound.

I declare further that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United State Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Signed this 18<sup>th</sup> day of May 2004.

Hiroshi Moriuma  
Hiroshi MORIUMA